

CONDUCTIVE OR STATIC DISSIPATIVE COATING

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Background of the Invention

1. Field of the Invention

This invention relates to a film, specifically a self-sustaining film or a laminae in a laminated construction or a coating for such laminated construction which is electrically conductive and/or possesses static electricity dissipative properties. These materials can be used especially to package electronic components which may be affected by or damaged by the build-up of static electricity during transportation, handling or storage of the electronic part.

2. Background of the Invention

Resinous materials, e.g. polymeric materials, are known to be useful for formation of coatings, self-sustaining films, laminae in laminated constructions and coating thereon. However, inherent in the use of polymeric materials is the fact that they are typically non-conductive to electricity and, in fact, such materials are used widely as insulators because of these non-conductive properties.

Prior attempts at imparting electrically conductive properties to polymers include the inclusion of conductive materials, especially a material such as carbon or similar material, e.g. graphite, as a filler to the polymeric material. The inclusion of a material such as carbon is only effective if it is provided in such an amount (by weight or volume) and dispersed uniformly throughout the polymeric material so as to form a continuous pathway for transmission of electrical energy. The inclusion of such large amounts of filler and the problem of uniformly dispersing a material such as carbon greatly influences the conductive properties of the resulting composite material. Due to its nature, i.e. its inherent color, the use of carbon also imparts a predominately black color to any polymeric material into which it is incorporated in electrically conductive amounts.

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Therefore, there is a requirement in the packaging industry for materials which are more aesthetically pleasing than a black plastic film.

Summary of the Invention

A film or coating which is composed primarily of a polymeric material is provided with conductive or static dissipative properties having particular utility for packaging electronic components, which are subject to deterioration of properties by build-up of static electricity during storage, shipping and handling and/or electrically conductive materials in a form of a self-sustaining film, as a laminae in a laminated construction or as a coating on paper or in a laminated construction for the purpose of imparting conductive or static dissipative properties to the polymeric material. Such polymeric material having the conductive or static dissipative properties can be used as packaging materials, especially for packaging electronic components.

Detailed Description of the Preferred Embodiments

Polymeric materials such as acrylic based polymers, especially methylnmethacrylate containing polymers, are excellent for forming coatings and films because of their physical properties, especially their optical clarity. These properties make it desirable to use such materials as a component for packaging after manufacture. However, such polymeric materials do not conduct or transmit electrical energy and are generally known as "insulators," i.e. are non-conductive to electrical current.

The present invention discloses a novel formulation for imparting electrical conductivity or static dissipative properties to polymeric materials by mixing between about 1 to about 10 wt % of a material imparting a surface resistivity (as measured by ASTM D-257 test method conducted at 12% relative humidity) so as to have a static dissipative property of less than 10^{12} ohms/sq and a conductive property of less than 10^5 ohms/sq. A material suitable for mixing with

the polymeric material is a quaternary ammonium compound. These quaternary ammonium compounds, in a solvent/carrier of an alcohol, preferably an isopropanol/ethanol mix, results in a liquid material which is easily mixed with the polymeric material. The quaternary ammonium containing liquid preferably contains about 41% by weight alcohol and most preferably 40% isopropanol and 1% ethanol. Quaternary ammonium salts have been used as softeners, especially in laundry formulations, or as applied to paper or foam substrates introduced during drying of laundered clothes. However, no use of these materials as a component of a film, laminate or coating has been known prior to the invention. A suitable material can be obtained from ACL Inc., 1960 E. Devon Avenue, Elk Grove Village, Illinois 60007, under the name "STATICIDE 3000G." Such a material is commercially available in liquid concentrate form appearing as a clear yellow substance with a pleasant odor, having an evaporation rate greater than water. As sold, "STATICIDE 3000G" has a specific gravity of 0.97, a density (g/ml) of 0.97, a vapor pressure (mm) at 20°C of 36 and a vapor density of 2.1. Percent volatiles (by volume) is about 40% with a pH of 7.1±1.

After mixing the quaternary ammonium containing liquid with the polymeric material, the resulting composition can then be formed into a self-sustaining film or used as a laminae of a lamination construction or as a coating for paper or a lamination construction. When used in a lamination construction, the conductive or static dissipative containing material of the present invention should preferably be used as the outer layer, i.e. on one or both sides of the film. Between the outer layers of the film, additional laminae may include a metallicized or non-metallicized surface and one or more layers of plastic film, fabric, non-woven material or paper, each of which is either coated or non-coated with coatings. The mixture of quaternary ammonium containing liquid and other components can be formed into a film, applied as a

coating or formed into a laminae by conventional techniques known to the art for making other polymeric films, coatings and/or laminae.

Typical requirements of a self-sustaining film would be one having a thickness between about 0.5 to about 500 mils and having a tensile strength (measured by ASTM D-882 test method of 0-100 lbs. per square inch). Puncture resistance (as measured by FTMS 101C method 2065) is 0-150 lbs. The haze (as measured by ASTM D-1003 test method) is clear to opaque; an optical density (measured by the McBeth test method) of 0-4.0% and a light transmission (measured by ASTM D-1003 test method) of 0-100%. Seam strength of a film made into a package as tested by ASTM D-882 test method should destruct.

The best mode contemplated by the inventor for carrying out the invention is illustrated by the following examples:

Example 1 (all parts being by weight)

<u>Parts</u>	<u>Component</u>
27.0	H ₂ O
2.6	NH ₄ OH 28°
336.0	Joncryl 82*
74.0	Joncryl 61**
29.8	Jonwax 28***
15.0	Zinc Oxide Solution****
120.0	H ₂ O
3.0 - 60.0	Staticide 3000G

*Methylmethacrylate aqueous solution sold by S.C. Johnson & Sons, Inc., U.S. Specialty Chemicals, 1525 Howe Street, Racine, Wisconsin.

**Methylmethacrylate aqueous solution sold by S.C. Johnson & Sons, Inc., U.S. Specialty Chemicals, 1525 Howe Street, Racine, Wisconsin.

***A polyethylene wax emulsion containing about 35% solids sold by S.C. Johnson & Sons, Inc., U.S. Specialty Chemicals, 1525 Howe Street, Racine, Wisconsin.

****Actually a dispersion of zinc oxide particles in an aqueous vehicle.

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Example 2

<u>Parts</u>	<u>Component</u>
400.0	Spectra-Guard 763*****
110.0	H2O
4.0 - 20.0	3000-G Staticide Concentrate

Example 3

<u>Parts</u>	<u>Component</u>
400.0	Spectra-Guard 763
110.0	H2O
4.0-20.0	3000-G Staticide Concentrate
5.0-25.0	Joncryl 89*****

The foregoing examples illustrate a conductive material content of between about 1 to about 10% by weight sufficient to form a coating, a self-sustaining film and/or a laminae in a laminated construction providing the surface resistivity mentioned above.

The chemical properties including the property of contact corrosivity as measured by FTMS 101C method 3005 showed no visible sign after testing of deterioration; has an ion content (sodium, fluoride, phosphate and sulfate ions) below detectable levels and is amine and amide free.

It will be apparent to those skilled in the art that I have provided a formulation which permits the attainment of a coating, film or laminated construction based primarily on a polymeric system which is static dissipative and/or conductive to electrical energy, permitting the formulation of aesthetic packaging materials, especially for packaging electronic parts which

*****A film forming material commercially available from Spectra-Kote Corporation, Fourth Street and East Water Street, Gettysburg, Pennsylvania and described in U.S. Patents 5,393,566 and 5,531,863, the entire disclosures of which are herein incorporated by reference.

*****Sold commercially by S. C. Johnson & Sons, Inc., U.S. Specialty Chemicals, 1525 Howe Street, Racine, Wisconsin.

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can be damaged by static electricity during storage, shipping and/or handling. However, it will be apparent to those skilled in the art that other formulations and uses thereof could be employed without departing from the spirit and scope of the invention.

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